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<p>(54) Title: <b>CHEWING GUM CONTAINING HYDROPHOBIC FLAVORANT ENCAPSULATED IN A HYDROPHILIC SHELL</b></p> <p>(57) Abstract</p> <p>Disclosed is chewing gum containing a flavoring component in which the flavorant is encapsulated in a hydrophilic shell.</p>		

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CHEWING GUM CONTAINING HYDROPHOBIC  
FLAVORANT ENCAPSULATED IN A HYDROPHILIC SHELL

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BACKGROUND OF THE INVENTION

The present invention relates to chewing gums. It relates in particular to gums and candy containing flavorants, and particularly flavorants of natural or artificial origin. The invention relates more particularly to gums having a particular flavoring component which comprises a specially prepared combination of flavorant and encapsulating agent.

The pertinent literature describes gum formulations in which the flavorant is entrapped, encapsulated, impregnated within porous microbeads or is otherwise physically surrounded. One example is U.S. Patent No. 5,128,155 which describes a chewing gum having a flavor releasing composition comprising a cellulosic material, a silica and a flavoring agent. The cellulosic material or other thermoplastic or thermosetting material is required by this patent to be present in the core which contains the flavoring agent. Thus, the constituent embodying the flavoring agent comprises several ingredients which are otherwise inert to the gum. The cellulosic or equivalent material, particularly when present simultaneously with silica in the gum, poses the risk of detracting from the desirable texture when chewed. This aspect seriously undermines the attractiveness of the purported advantage described in U.S. Patent No. 5,128,155, since a gum which is gritty or otherwise has an unattractive texture in the

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1 mouth will not be purchased regardless of how the flavor  
is presented in the gum.

U.S. Patent No. 4,001,438 discloses flavor  
compositions useful in chewing gums. Here, also, the  
5 flavoring component requires the presence of a solid  
suspending agent such as colloidal silica, xanthin gum  
or ethyl cellulose. Thus, the flavor-bearing  
constituent to be incorporated into the gum is required  
by this patent to be composed of a multiplicity of  
10 ingredients which do not otherwise contribute to the  
desirable characteristics of the gum such as texture or  
flexibility.

U.S. Patent No. 4,963,369 discloses a chewing  
gum in which flavor ingredients are impregnated into  
15 porous polymeric beads. This patent is yet another  
example of gum formulations containing components in  
which the flavoring ingredient is physically trapped.

Those familiar with the manufacture of chewing  
gums and confections are aware that flavoring agents can  
20 be vulnerable to gradual degradation in finished  
products. This degradation can even be accelerated  
through mediation by one or more other ingredients  
present in the product. By "mediation" is meant that  
the presence of such other ingredient(s) in the form in  
25 which it or they are present appears to accelerate the  
decomposition of the flavoring agent, regardless of  
whether the mechanism of decomposition is chemical  
reaction, catalysis of reaction with other components,  
oxidation, or otherwise. The products which have the  
30 potential for mediating the degradation of the  
flavorants include sweeteners or other agents whose  
presence is obviously desirable in the final product.

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1 Past attempts to prevent or retard degradation of the  
flavorants have generally involved physically separating  
or isolating the flavorants within the formulation, by  
means such as encapsulation or other physical entrapment  
5 mechanisms, in order to enable the flavorants present to  
contribute as fully as desired to the flavor of the  
final product.

It is also recognized in this art that the  
consumer's perception of the flavorant(s) upon chewing  
10 is important to the acceptance of the gum or confection  
by the consumer. Attributes including the initial  
impact of flavor upon the onset of chewing, and the  
extension of duration of the flavor during chewing, are  
particularly important. Achieving a desirable balance  
15 of both properties is a challenge, particularly since it  
is frequently found that techniques which enhance one  
such property do so to the detriment of the other.

Thus, there is a need for chewing gum  
compositions which satisfy the objectives of exhibiting  
20 a sufficient degree of initial flavor impact while  
protecting, and even enhancing, flavor extension and the  
stability of the flavorants present.

#### BRIEF SUMMARY OF THE INVENTION

25 The present invention meets the aforementioned  
objectives as well as other desired characteristics that  
will be apparent.

In one aspect, the present invention comprises  
30 a chewing gum comprising a gum base, a flavoring  
component, and optionally a sweetening component,  
wherein the flavoring component consists of particles of

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1 one or more hydrophobic flavorants encapsulated in a  
hydrophilic shell.

Another aspect of the invention is an improved  
method of making chewing gum by combining in any  
5 sequence gum base, a flavoring component as described  
herein, and, optionally, a sweetening component. The  
gum made by this method provides strong initial flavor  
impact, extends the flavor, reduces plasticization of  
the gum by the flavorant, and retards or prevents  
10 oxidative degradation of the flavorant.

#### DETAILED DESCRIPTION OF THE INVENTION

The invention will be described with respect  
15 to its embodiment in chewing gums, by which is meant  
gums in all forms whether sugar-containing or sugar-  
free, bubble gum or conventional chewing gum, and the  
like. The chewing gum of the present invention  
comprises the gum base itself, optional solvents, and/or  
20 plasticizers. The amount of gum base employed will vary  
greatly depending on various factors such as the type of  
base used, consistency desired and other components used  
to make the final product. In general, amounts of about  
5% to about 50% by weight of the final chewing gum  
25 composition are acceptable for use in the chewing gum  
compositions, preferred amounts thereof being about 15%  
to about 25% by weight.

The gum base may be any water-insoluble gum  
base well known in the art. Illustrative examples of  
30 suitable polymers in gum bases include both natural and  
synthetic elastomers and rubbers. For example, those  
polymers which are suitable in gum bases include,

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- 1 without limitation, substances of vegetable origin such  
as chicle, jelutong, gutta percha and crown gum.  
Synthetic elastomers such as butadiene-styrene  
copolymers, isobutylene-isoprene copolymers,  
5 polyethylene, polyisobutylene and polyvinyl acetate, and  
mixtures thereof, are particularly useful.

The gum base composition may contain elastomer  
solvents to aid in softening the rubber component. Such  
elastomer solvents may comprise methyl, glycerol or  
10 pentaerythritol esters of rosins or modified rosins,  
such as hydrogenated, dimerized or polymerized rosins,  
or mixtures thereof. Examples of elastomer solvents  
suitable for use herein include the pentaerythritol  
ester of partially hydrogenated wood rosin,  
15 pentaerythritol ester of wood rosin, glycerol ester of  
partially dimerized rosin, glycerol ester of polymerized  
rosin, glycerol ester of tall oil rosin, glycerol ester  
of wood rosin and partially hydrogenated wood rosin and  
partially hydrogenated methyl ester of rosin, such as  
20 polymers of alpha-pinene or beta-pinene; terpene resins  
including polyterpene; and mixtures thereof. The  
solvent may be employed in an amount ranging from about  
10% to about 75% and preferably about 45% to about 70%  
by weight to the gum base.

- 25 The gum base can also contain any of a variety  
of traditional ingredients such as plasticizers or  
softeners such as lanolin, stearic acid, sodium  
stearate, potassium stearate, glyceryl triacetate,  
glycerine and the like and/or waxes, for example,  
30 natural waxes, petroleum waxes, such as polyethylene  
waxes, paraffin waxes and microcrystalline waxes, to  
obtain a variety of desirable textures and consistency

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1 properties. These individual additional materials are  
generally employed in amounts of up to about 30% by  
weight and preferably in amounts of from about 3% to  
about 20% by weight of the final gum base composition.

5 The chewing gum composition may additionally  
include conventional additives such as emulsifiers such  
as lecithin and glyceryl monostearate; and additional  
fillers such as aluminum hydroxide, magnesium hydroxide,  
alumina, aluminum silicates, calcium carbonate, and talc  
10 and combinations thereof. These fillers may be used in  
the gum base in various amounts. Preferably the amount  
of fillers when used will vary from about 4 to about 30%  
by weight of the final chewing gum.

The chewing gums of this invention also  
15 contain a flavoring component which comprises particles  
of a hydrophobic flavorant encapsulated in a shell of a  
hydrophilic material.

Suitable flavorants include both natural and  
artificial flavors and mints, such as oil of peppermint,  
20 menthol, oil of spearmint, vanilla, oil of cinnamon, oil  
of wintergreen (methyl salicylate), and various fruit  
flavors, including but not limited to lemon oil, orange  
oil, grape flavor, lime oil, grapefruit oil, apple,  
apricot essence, and combinations thereof. The  
25 flavorings are generally utilized in amounts that will  
vary depending upon the individual flavor. Optionally,  
a small amount of a vegetable oil or equivalent material  
can be added to the flavor oil when it is desired to  
lessen any overly strong impact of the flavor.

30 The flavoring component of the gums of the  
present invention (i.e. flavorant plus shell) preferably  
comprises about 0.005% to about 3.0% by weight of the

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1 final chewing gum product. The flavoring component, in  
turn, preferably comprises about 20 to about 90% by  
weight flavorant, and the balance the shell.

5 The shell is composed of any hydrophilic, or  
water-soluble, shell-forming material, such as gelatin,  
agar, shellac, gum arabic, alginic acid and salts  
thereof, and xanthan gum. Mixtures of any of the  
foregoing can also be used.

10 The present invention contributes ease and  
economy of formulation, with an unprecedented  
realization of benefits. Those benefits include  
unimpeded onset of flavor during the initial chew  
coupled with a prolonged extension of the flavor effect  
during chewing, all of which are realized together with  
15 the full, undegraded effect of the flavoring component.  
Other benefits include lessening of the plasticization  
of the gum base by the flavorant, and retarded or  
eliminated oxidation of the flavorant.

Notably, the use of the encapsulated flavoring  
20 component as described herein permits attainment of a  
given level of flavor perception with less flavorant;  
that is, the availability of the flavorant appears  
enhanced. Indeed, gums of the present invention achieve  
far greater flavor impact than is achievable by other  
25 known flavoring techniques. This advantage is  
particularly unexpected since the shell would be thought  
to introduce around the flavor a barrier to flavor  
perception which is not present in conventional gums.  
Without being bound by any particular theory, it is  
30 believed that the encapsulated flavorant is less likely  
to be masked within the gum base, by absorption into the  
gum base or otherwise; under this theory, a greater

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1 proportion out of any total loading of flavor is  
"available" for perception by the consumer. In  
conventional gum formulations wherein the flavorants are  
not encapsulated, certain components of the flavorant  
5 can become entrapped in the gum base; or, components of  
the flavorant can be lost during processing of the gum.  
The result can be an unwanted change to the character of  
the flavor.

The present invention minimizes these  
10 problems. In addition, particularly when the present  
invention is carried out using liquid flavorant oils or  
solutions, the present invention permits the operator to  
avoid unwanted loss of flavor components if the operator  
chooses to dry (spray-dry) the flavorant. This, in  
15 turn, reduces the cost of the operation and permits  
retention of the more volatile components of the  
flavorant, as drying generally requires the application  
of heat which absent the encapsulating shell would drive  
off the more volatile components and could even alter  
20 the structure of flavor components. As a result, the  
perceived flavor is stronger and fuller.

Preparation of the encapsulated flavoring  
component used in the present invention can be carried  
out by the techniques described in European Patent  
25 Application No. 89303098.1, the content of which is  
hereby incorporated herein by reference. In general, an  
aqueous solution is formed of hydrophilic material such  
as gelatin, gum arabic, agar, shellac, or a mixture of  
two or more of these. Then, hydrophobic flavorant is  
30 added in small droplet amounts. It is often  
advantageous to add a small amount of a food grade  
emulsifier such as lecithin or a monoglyceride or

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1 diglyceride, sorbitan monostearate, or polysorbate 60,  
and then to agitate and emulsify the system. Using  
gelatin as an example of a hydrophilic shell material,  
the gelatin is then caused to turn into a solid by one  
5 of several techniques, such as:

1. pH adjustment to the isoelectric point of  
the gelatin, typically pH 4.8 using a dilute acid,
2. Increasing the osmotic pressure by slow  
addition of a salt that causes the gelatin to  
10 precipitate, such as sodium citrate,
3. Slow addition of a polymer nonsolvent that  
causes the polymer (gelatin in this case) to thicken and  
form a solid. Ethanol could be used in this example.
4. Slow cooling of the system so the gelatin  
15 would set up.

Another process of interest would involve  
complex coacervation. Here a mixture of e.g. 1% gelatin  
and 1% gum arabic are mixed with peppermint oil.  
Gelatin can have a range of isoelectric points from 4 to  
20 9, depending on the procedure used in making it.  
Assuming that the gelatin has an isoelectric point of  
4.8, then above a pH of 4.8, the gelatin is negatively  
charged. Below pH 4.8, the gelatin is positively  
charged. By contrast the gum arabic contains many  
25 carboxylic acid groups. Therefore it is negatively  
charged. When the mixture is made, the pH should be  
above pH 4.8, so both the gelatin and the gum arabic are  
negatively charged. At this point they do not react  
with each other. Then acetic acid, or dilute  
30 hydrochloric acid is added. As the pH drops below pH  
4.8, the gelatin becomes positively charged and is  
therefore attracted to the gum arabic. They therefore

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1 precipitate and form a shell around the peppermint oil.  
This would provide a stronger shell than one containing  
gelatin alone.

5 The particles, however formed, can then be  
recovered e.g. by filtration or centrifugation, and then  
dried, for instance in a spray dryer or a fluid bed  
dryer.

The particles can generally be about 0.1 mm to  
about 3.0 mm in diameter; since these limits are not  
10 believed to be critical, particle diameters outside this  
range are believed useful. Preferably a greater  
fraction or all of the particles are about 0.1 mm to  
about 1.0 mm in diameter. It will be recognized that a  
gum formulation can contain particles having a range of  
15 different diameters.

Relative amounts of flavorant to shell can be  
adjusted depending on the desired taste characteristics  
of the final product. It is a significant and  
unexpected advantage of this invention that the  
20 advantages described herein can be realized over a wide  
range of ratios of flavorant to shell.

The present invention contemplates the  
optional inclusion in the chewing gum of a sweetener  
component which comprises any one or more sweeteners  
25 known in the art, including both natural and artificial  
sweeteners. Thus, sweeteners may be chosen from the  
following non-limiting list, which includes sugars such  
as sucrose, glucose, corn syrup, dextrose, invert sugar,  
fructose and mixtures thereof; saccharine and its  
30 various salts such as the sodium or calcium salt;  
cyclamic acid and its various salts such as the sodium  
salt; free aspartame; dihydrochalcone sweetening

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1 compounds; glycyrrhizin; Stevia rebaudiana (Stevioside);  
monellin, thalmatin, Sucralose, neosugar, and  
polydextrose; and sugar alcohols such as sorbitol,  
sorbitol syrup, mannitol, xylitol, isomaltitol,  
5 lactitol, maltitol, and the like. Also contemplated as  
a sweetener is the nonfermentable sugar substitute  
hydrogenated starch hydrolysate (also known as Lycasin)  
which is described in U.S. Pat. No. Re. 26,959. Also  
contemplated is the synthetic sweetener 3,6-dihydro-6-  
10 methyl-1-1,2,3-oxathiazin-4-one-2,2-dioxide,  
particularly the potassium (Acesulfame-K), sodium and  
calcium salts thereof as described in German Patent No.  
2,001,017.7.

As indicated, products within the scope of the  
15 present invention may include no sweetener at all. If  
sweetener is included, the amount of sweetener is  
effective to provide the desired degree of sweetness,  
generally 0.001 to 70 wt.% of the final product.  
Colorants can be present in the chewing gums and  
20 confections of the present invention. Examples include  
the pigments such as titanium dioxide and other dyes  
suitable for food, drug and cosmetic applications known  
as F.D. & C. dyes, and the like. The materials may be  
incorporated in amounts of up to about 6% by weight,  
25 preferably under about 1% by weight.

Chewing gums in accordance with the present  
invention are formulated in accordance with essentially  
conventional processing technology. Thus, preferably,  
the gum base including any resins, plasticizers, fillers  
30 and/or other gum base components are softened together  
by heating and then mixed together with the flavoring  
component, and the mixture is stirred together for a

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1 time sufficient to insure a homogenous mass. The mass  
can be formed into pellets or into slabs from which  
individual stick-type pieces are cut using technology  
familiar to those skilled in this art.

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## EXAMPLE

Chewing gum is prepared from the components set forth in the following Table 1:

5	TABLE 1 (all amounts in wt. %)	
	Component	Amount
	Sorbitol powder	42.6%
10	Gum base	30.0
	Hydrogenated glucose syrup	17.0
	Glycerin	5.0
	Sorbitol solution, 70%	4.0
	Peppermint oil	1.0
15	Peppermint oil encapsulated in gelatin	0.1
	Aspartame	0.3
	TOTAL	100.00

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1 WHAT IS CLAIMED IS:

1. A chewing gum comprising a flavoring component, said flavoring component comprising particles having a hydrophilic shell encapsulating one or more  
5 hydrophobic flavorants, wherein said one or more flavorants are releasable from said shell upon chewing of said gum.

2. A chewing gum according to Claim 1 wherein in said particles said flavorants comprise about  
10 20 to about 90 wt.% thereof and said shell comprises about 10 to about 80 wt.% thereof.

3. A chewing gum according to Claim 2 wherein in said particles said flavorants comprise about  
15 70 wt.% thereof and said shell comprises about 30 wt.% thereof.

4. A chewing gum according to Claim 1 wherein said particles comprise about 0.005 to about 3.0 wt.% of said gum.

5. A chewing gum or confection according to  
20 Claim 1 wherein said flavorant is selected from the group consisting of peppermint oil, menthol, cinnamon oil, spearmint oil, vanilla, wintergreen oil, lemon oil, orange oil, grape, lime oil, grapefruit oil, apple, apricot essence, and mixtures thereof.

25 6. A chewing gum or confection according to Claim 1, further comprising a sweetener.

7. A chewing gum according to Claim 6 wherein said sweetener is selected from the group consisting of sucrose, glucose, corn syrup, dextrose,  
30 invert sugar, fructose, saccharine, salts of saccharine, cyclamic acid, salts of cyclamic acid, aspartame, dihydrochalcones, glycyrrhizin, Stevia rebaudiana,

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1 monellin, thalmin, Sucralose, isomaltitol, neosugar,  
lactitol, polydextrose, maltitol, sorbitol, sorbitol  
syrup, mannitol, xylitol, hydrogenated starch  
hydrolysate, Acesulfame, salts of Acesulfame, and  
5 mixtures thereof.

8. A chewing gum according to Claim 1  
wherein said shell is made of material selected from the  
group consisting of gelatin, agar, shellac, gum arabic,  
alginic acid and salts thereof, xanthan gum, and  
10 mixtures thereof.

9. A chewing gum according to Claim 1  
wherein particles comprising said flavoring component  
have diameters of about 0.1 mm to about 3.0 mm.

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## INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US94/06971

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(5) :A23G 3/30

US CL :426/5

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 426/3, 4, 5, 6, 96, 650,651

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US, A, 5,004,595 (CHERUKURI ET AL) 02 April 1991, see entire document.	1-9
Y	US, A, 4, 001,438 (MARMO ET AL) 04 January 1977, see entire document.	1-9
Y	US, A, 4,963,369 (SONG ET AL) 16 October 1990, see entire document.	1-9

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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